### Required Training

- UC Lab Safety Fundamentals

### Required PPE

- Lab coat, safety glasses/goggles, nitrile gloves

### Equipment

- “Chemistry Club” neon-style glass tubing on cardboard

### Chemicals

- 3-aminophthalhydrazide (luminol)

- Sodium Carbonate (Na$_2$CO$_3$) and bicarbonate (NaHCO$_3$)

- Ammonium carbonate monohydrate ((NH$_4$)$_2$CO$_3$·H$_2$O)

- Copper sulfate pentahydrate (CuSO$_4$·5H$_2$O)

- Hydrogen peroxide (H$_2$O$_2$), 30% solution

### Procedure:

1.) Preparation of solutions (for 1L of each):

To make the Luminol A solution (light-sensitive, store in amber bottle), dissolve the following in 1 L deionized H$_2$O:

- 4 g Na$_2$CO$_3$
- 0.2 g luminol
- 24 g NaHCO$_3$
- 0.5 g (NH$_4$)$_2$CO$_3$·H$_2$O
- 0.4 g CuSO$_4$·5H$_2$O

To make the Luminol B solution, dissolve 5 mL H$_2$O$_2$ in 1 L deionized H$_2$O.

2.) Prop the “Chemistry Club” glass tubing up against a wall or have two performers hold it upright. Make sure that the outlet tube is open and is held above the level of the funnel attached to the top of the glass tubing.

3.) With the lights off, simultaneously pour equal volumes of Luminol A and Luminol B into the funnel attached to the top of the glass tubing. Pour slowly to avoid vapor-locking the funnel, and make sure that the solution is flowing through the
4.) After the demonstration is complete, place the outlet tube into a bottle and drain the solution from the glass tubing.

**Clean-up:** Collect the spent luminol solution for disposal as hazardous waste. Thoroughly rinse the glass tubing with water and allow it to dry.

**Hazards:** 30% H₂O₂ is corrosive and strongly oxidizing, causing immediate chemical burns on contact with skin. Always wear nitrile gloves when preparing, performing, or cleaning up this demo. CuSO₄ is toxic if ingested, and is harmful to the environment.

**Principle:** The Cu²⁺ catalyzes the decomposition of H₂O₂, producing oxygen (O₂). In the presence of hydroxide ions (OH⁻), the di-anionic form of luminol is oxidized by O₂, forming an unstable organic peroxide. This decomposes to an excited-state molecule, which then relaxes to a lower energy state and emits the excess energy as a photon of blue light. The iron in hemoglobin can also act as a catalyst, allowing forensic chemists to use luminol to detect trace amounts of blood at crime scenes.

**Notes:** The current “Chemistry Club” sign is extremely difficult to use for this demonstration, as many of the bends are sharp enough to prevent continuous flow, and instead cause the funnel to vapor lock. It may be more impressive to mix the two solutions in a large spiral tube or even a large flask, as the luminescence only lasts for a few moments.

**Source for Luminol:** - Aldrich, Cat# 12,307-2: 3-Aminophthalhydrazide